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ABSTRACT

Research was conducted into the metacognitive awareness of electronics workers in completing job reading tasks. The study examined how successful adult readers make decisions about why, when, and how to use reading on the job. It also identified unique aspects of the job reading context that both require workers to control their reading efficiently and productively and help them to do so. These included the role of workers' job experience as an aid in reading, readers' perceptions of what makes text difficult or easy to use, and the availability and use of sources of information other than print. Suggestions were made for incorporating metacongition training into job training programs to help adult readers make the most effective use of their work environments. Specific recommendations were that (1) job-related reading instruction needs to teach workers to be aware of the interaction of factors that work together to influence reading success; (2) because of the importance of efficiency and productivity on the job, workers need to develop personal strategies for effective use of reading; (3) those who generate materials to be read on the job must consider how, when, and where these materials are used; and (4) job training should include direct experience with and instruction in the specific materials and reading tasks encountered in the job. (YLB)

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METACOGNITIVE AWARENESS IN JOB-RELATED READING

by

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Job-related reading takes many forms: The engineering manager hurriedly thumbing through a trade journal to see what is new in her field, the production supervisor scanning a computer printout to find a missing part number, and the technician looking back and forth between an electrical schematic and a broken circuit board are all reading. Although each spends a different amount of time, finds different information, and completes a different job task, each of these adults will use reading in some form many times throughout the day.

Educators and business leaders agree that reading is an important tool of the workplace. However, little is known about the best way to help novice workers develop effective on-the-job reading skills. When the school doors close and the workplace gates swing open, classroom-nurtured reading skills may not serve the worker as well as they served the student. The workplace imposes a context for literacy different from the classroom where reading is used mainly to learn concepts or information (Mikulecky, 1982).

Because of the high level of reading sophistication required by most job categories, training programs need to help workers adapt classroom-based reading abilities to the workbench or office. Research in job-related reading has identified some of the variables that comprise reading in the context of the job (e.g., Diehl, 1980) and has described how reading is used in many occupations (e.g., Sticht & Kern, 1970; Sticht, Fox, Hauke & Zapf, 1977; Miller, 1982; Kirsch & Guthrie, 1983; Mikulecky & Winchester, 1983). To design effective programs to develop job-related reading abilities, more must be known about the underlying cognitive processes adults use when applying reading

skills to job tasks (Diehl, 1980).

This paper is based on research on the metacognitive awareness of electronics workers in completing job reading tasks. The study examined how successful adult readers make decisions about why, when, and how to use reading on the job. The study also identified unique aspects of the job reading context that both require workers to control their reading efficiently and productively and help them to do so. Based on this research, the paper presents suggestions for incorporating metacognition training into job training programs to help adult readers make the most effective use of their work environments.

Metacognition and Job-Related Reading

Metacognition involves a reader's ability to step back from the reading task and examine how she or he goes about completing the task. In a job context, the following would be examples of metacognition: A technician realizes that the text of a manual does not make sense, and that he will have to refer to an accompanying diagram for clarification; a secretary double-checks the memo for typing errors because she knows she makes more mistakes at four-thirty than at nine in the morning; realizing that he doesn't understand a customer's order, a service manager writes a note to remind himself to call and confirm the details. Cognition refers to the thinking processes the service manager, for example, used to write the note. He displayed metacognition when he realized his confusion over the customer's request and recognized the need to write the note.

Success in reading is influenced by the reader's awareness of and control over four factors that work together: the task or

goal of reading; the difficulty, familiarity and structure of the material to be read, the strategies used, and the reader's abilities and background knowledge (Brown, Campione & Day, 1981; Flavell & Wellman, 1978). Effective readers not only understand how these factors interact during reading but actively control the process of reading.

According to Flavell (1979), metacognition may occur most readily in contexts that generate a high degree of precise and conscious thinking, as on the job. Situations where decisions are important and risks high, where actions require planning and evaluation, require "the kind of quality control that metacognitive experiences can help supply" (p. 908). Perhaps adults who have greater awareness of their reading processes use them more effectively to accomplish the day-to-day reading tasks that are of primary importance to job success.

Clearly, effective reading is integral to occupational success. Reading in all its forms is a required part of the vast majority of occupations (Diehl & Mikulecky, 1980) and accounts for most of the reading that working adults do daily (Mikulecky, Shanklin & Caverly, 1979). Although job-related reading occupies an average of nearly two hours of the work day across all occupational levels (Sticht, 1975; Diehl, 1980; Mikulecky, 1982), many reading tasks occur in short sessions of fewer than five minutes (Kirsch & Guthrie, 1983). Furthermore, reading is crucial in technical and managerial positions (Miller, 1982). As occupational level increases, so does the intensity of job-related reading demands as well as the variety of reading strategies workers must use (Diehl, 1980). Working adults in general consider job-related reading to be an expected, important

part of their occupations (Mikulecky, 1982; Mikulecky & Winchester, 1983).

The reading tasks that occupy so much of a worker's day differ from those in other reading contexts. For one thing, the goal of reading is to complete a job task rather than to learn new information (Sticht, 1977). For example, an engineer might use the same manual repeatedly to find a particular specification for a series of similar designs. She has no need to memorize the specification because she knows that the manual is more efficient than her memory. Reading on the job occurs in "an information-rich context" (Diehl, 1980, p. 264). Workers use a variety of information sources in addition to those which come from reading. For example, the same engineer might consult a manual, a set of government regulations and a knowledgeable colleague all as information sources for accomplishing one task. Workers use reading as one of many processes for doing their work.

Research has established the importance of metacognition in the development of reading as a process for learning (Armbruster, Echols & Brown, 1983). However, little attention has been given to the development of metacognition for reading tasks beyond the classroom. In particular, research on metacognitive factors in adult reading that may partially explain job-related reading success is limited. Mikulecky and Ehlinger (1986) identified how metacognitive abilities related to job performance. Other studies of adults, including the self-reported reading behavior of college students (Hare & Pulliam, 1980) and of adult disabled readers (Gambrell & Heathington, 1981), have also examined metacognitive variables in adult readers but only within the context of reading to learn new information. The present study

explored how metacognitive awareness operates in job-related reading to develop job training techniques for improving reading effectiveness in the specific and complex context of the workplace.

The Study

Although previous research has described what readers do on the job, the present study investigated workers' awareness of why they do what they do to develop an operational definition of how metacognitive awareness is used in job-related reading. The study examined subjects' metacognitive awareness of factors that have been shown to influence job reading success: reading ability, the reading demands of the job, experience in the job, and the availability and use of sources of information other than print. The subjects of the study were thirty managers and supervisors in the electronics industry.

In structured interviews, subjects answered questions from the Diehl-Mikulecky Job Literacy Survey (Diehl, 1980) and the Survey of Metacognitive Factors in Job Reading (SMFJR) developed for this study to elicit information about awareness of metacognitive factors that affect reading. Questions from the SMFJR were specifically designed to measure comprehension monitoring, an aspect of metacognitive awareness that was not examined by Mikulecky and Ehlinger (1986).

Transcripts of subject responses were analyzed for statements that indicated awareness of four metacognitive features: the goal or purpose of reading (TASK), features of text that made reading easy or difficult (TEXT), deliberate strategies used in reading (STRATEGY), and personal

characteristics and abilities that influenced reading success (READER CHARACTERISTICS).

For example, in the following transcript describing one subject's awareness of how experience as a service department supervisor has aided job-related reading, several different features work together:

> The volume of reading has gone up so much (awareness of task) since I became a supervisor that, even though I don't feel I'm totally efficient at reading, I have improved (awareness of reader characteristics). I try to set aside certain times for reading, and I've learned how to scan things better (awareness of strategy). If I don't feel I've gotten the full gist from scanning, then I sit down and read it word for word (awareness of strategy).

Each statement was similarly analyzed to identify subjects' metacognitive awareness of job-related reading.

Metacognitive Influences on Job-Related Reading

The study identified specific aspects of job-related reading in which metacognitive awareness may have particular influence on reading success: the role of workers' job experience as an aid in reading, readers' perceptions of what makes text difficult or easy to use, and the availability and use of sources of information other than print. The literature on job-related reading has identified these as important components of the context for reading on the job. The following sections describe more completely subjects' metacognitive awareness of the role of experience, use of non-print information sources, and sources of

text difficulty as examples of the way adults use metacognition in job-related reading.

The Role of Experience in Job-Related Reading

As a worker gains experience on the job, many things become easier. The technical language and jargon of the field take on real meanings. The format of written material becomes familiar and efficient to deal with. Procedures become automatic. In short, experience provides most of the background knowledge necessary to do a job.

For the subjects in this study, experience gained on the job increased their ability to deal with job-related reading tasks. Job experience influenced several metacognitive factors: self-perceptions of reading ability and efficiency; strategies for reading; perceptions of what made reading difficult; recognition of the most important reference source for the job; and, to some extent, the decisions subjects made as supervisors.

Specifically, the majority of subjects felt that the experience they had gained on the job provided the background knowledge and familiarity necessary to deal effectively with materials they read. Others said that their experience helped them understand technical terms as well as the job task to which materials referred, thus making reading easier. In fact, experience on the job sometimes must substitute for inadequate print references:

> We don't have well-documented systems and procedures manuals. On a day to day basis, the people that work for me rely on their own knowledge of the job, their own notes and personalized procedures that they have written for themselves, and they rely on me. Rarely do

we rely on some kind of printed manual.

In general, subjects in this study were aware that experience helped them bring together the tasks, texts, strategies, and their own abilities to use reading effectively in their jobs.

Use of Non-Print Information Sources

In this study, decisions to use print or to consult some other source for needed job information were based on efficiency, expediency, and productivity. Getting the job done was the prime consideration. When subjects explained how they chose whether to use print reference material or to ask someone for information, they demonstrated their awareness that the best reference source most often is whatever will provide needed information in the fastest, most efficient manner. These subjects made extensive use of a wide range of information sources on the job, both print and non-print.

For many subjects, their knowledge of the job task directly dictated what information source they used, whether print or a colleague. Subjects used the reference that provided the best information in the shortest time. Some subjects said they usually used print to look up information because text is more efficient or reliable than asking others.

> I almost always have to use print. There is no one else to ask on a lot of the material. The material ultimately involves contractual implications to the company, which means that I participate with others in determining the suitability and profitability of the particular task. It involves a lot of reading. There's not any place to turn except to read it and create the right answers.

However, using a text reference was not always the best approach. Many subjects relied on other workers for job-related information because asking provided more efficient, reliable, or in-depth information than print.

> Asking somebody always seems to be faster. If you know someone has expertise in an area, that certainly is an efficient way to get to the material you're after.

Subjects' comments about their use of non-print information sources support the conclusions of Diehl (1980) that what may look like literacy "demands" of the job are actually literacy "opportunities." With many sources of information at hand, workers select those that get the job done the best way at the time. The conscious selection and use of all available sources of information reflect metacognitive awareness.

Sources of Text Difficulty

The difficulty of reading materials influences how well the reader can understand and use them. While many subjects in this study felt that text would be hard for others to understand, they often had little trouble themselves. Again, many of these subjects felt that their job experience made a difference.

Most studies that have examined difficulty have relied on readability formulas to measure it (e.g., Diehl, 1980, used the FORCAST formula developed by Caylor & Sticht, 1973; Miller, 1982, used the Raygor Readability Estimator developed by Raygor, 1979). Readability formulas attempt to provide an estimate of the difficulty level of specific reading materials. However, if job-related reading is context- and situation-specific, difficulty should be considered a relative concept. That is, difficulty needs to be examined in relation to the reasons why someone

perceives materials as hard to read.

Subjects in this study described awareness of how the reading task, the text, and readers' strategies and abilities affected their perceptions of difficulty. For example, highly technical materials that would seem meaningless to someone outside of the field were simple and straightforward for engineers. Complex charts or schematics provided specific information necessary to repair an electronic instrument. Even unfamiliar text could be considered easy if the reason for reading was to get a general knowledge of what was said. In short, difficulty clearly lay in the mind of the reader.

> Some of the reports that I have to read are pretty technical, and I would say they are probably difficult for a lot of people to read. But I don't have trouble reading them because I have worked with it long enough to understand them. I think it's all related to experience.

However, many subjects felt that without adequate background knowledge of the topic, experience in the job or knowing what to look for, materials could be very difficult to understand.

The technical language of job reading materials, as well as cumbersome structure and dense, fact-laden text all contributed to subjects' perceptions of difficulty. For example, one subject described difficulty in deciphering customer specifications which detailed what was needed for a particular job but which were poorly written. Another response illustrated how the blending of print and graphic information, common in technical materials, also makes them more difficult to read.

> It's what I'd call "dense" material. You are looking

at a page that is filled with formulas and mathematical expressions, and it just takes a while to understand. It may be one page, but if someone were to write an explanation of it in longhand, it could well cover twenty to thirty pages.

Subjects' perceptions of text difficulty illustrated the interaction of metacognitive features. Reading materials were considered more or less difficult depending on the reason for reading, the type of material, subjects' own background knowledge, and their particular strategies. These subjects did not measure difficulty by one standard only, but by a number of interrelated standards.

Determining the difficulty of materials used in a job is important to the training and promotion of new employees. Workers must be able to get the job information they need from the materials that are available. From this study, it seems clear that difficulty needs to be considered from the point of view of a variety of factors other than sentence and word length.

Recommendations for Reading Instruction Through Job Training

Even within the same industry, the reading described in this study varied greatly: keeping up with advancements in the field through journal articles, deciphering customer specifications, decoding complex government policies and regulations, searching through company procedures for a specific task, reading engineering drawings, referring to electrical schematics. In short, these adult workers could not avoid reading.

Research has shown that instruction in metacognitive skills can increase learning in the classroom (see Armbruster, Echols &

Brown, 1983 for a review). If metacognition is also important on the job, then instruction may help adults become better prepared for the reading tasks they will encounter in the workplace. Readers need to be taught how, when and where to apply metacognitive skills and must understand the importance of assuming an active role in their reading.

Successful instruction programs not only present training in specific skills, but also incorporate training in awareness and control of metacognitive factors that influence reading (Baker & Brown, 1984). A job training program with a metacognition element would teach workers how to read an automobile repair manual, for example, and would extend the training to include instruction and practice in determining how, when, and in what way to make the best use of the manual depending on the particular job task (Schlick Noe, 1983).

Specific recommendations:

1. Job-related reading instruction needs to teach workers to be aware of the interaction of factors that work together to influence reading success. For example, many subjects in the present study believed that reading faster would help them get through more material and complete job tasks more efficiently. They wanted to remember more and to understand more thoroughly. However, the materials read in their technical jobs included schematics, engineering drawings, tables, computer printouts, detailed specifications -- materials that cannot necessarily be read faster and better. Workers need to be aware that their purpose for reading will both influence and be influenced by the type of material, their own background knowledge, and the strategy they select.

2. Because efficiency and productivity are important on the job, workers need to develop personal strategies for effective use of reading. Many sources of information surround workers, and they rely on knowledge of the job to know when and how to use reading and when to rely on other sources of information. In short, one of the most important qualities of effective readers is flexibility -- adapting reading strategies to fit a particular context.

One indication of flexibility is when readers transfer skills learned in a classroom context and apply them in the context of a job. Some specific school-based reading skills emerged when subjects talked about job-related reading. For example, one subject described how a school-learned SQ3R survey strategy had become integrated into his job-related reading because it proved to be an efficient strategy. He said he uses SQ3R "if I'm reading something that I will need, that I should remember for some period of time, or that I am going to have to use later." He has retained this particular study strategy because it works well for him in his job. This application of a common classroom study technique to a work reading context illustrates how metacognitive awareness can help workers transfer reading skills from school to the job.

Other metacognitive reading skills from the classroom that seem to have found a place in job-related reading are the processes of preview and review. Previewing material before reading and reviewing the information after reading are recognized processes to aid readers' comprehension of text (Anderson & Armbruster, 1984). When reading is primarily a task-accomplishing process, preview and review strategies may help

readers concentrate on important information. Two-thirds of the subjects in this study used some form of preview or review strategy for their job-related reading. These strategies included previewing reading materials to get an overview of content before reading for specifics, and using book parts such as an index or table of contents to find specific sections of text.

3. Those who generate the materials read on the job must consider how, when, and where these materials are used. A major cause of reading difficulty for the subjects of this study was the poor quality of materials they relied on to do their jobs. Reading is less efficient when the author of text does not know or write for the reader's background. Many materials from outside a workplace cannot be controlled, but materials generated from within need to consider readers' background knowledge and how the materials will be used.

4. Job training should include direct experience with and instruction in the specific materials and reading tasks encountered in the job. Training should prepare new workers for the specific reading tasks required by specific jobs. In addition, since the physical environment of the workplace -- the setting in which most work-related reading occurred -- may not be under the individual's control, workers must learn how to increase reading effectiveness under many different conditions.

The key to improving adults' technical literacy through improving metacognition may be that metacognitive abilities allow the reader to adapt reading skills to whatever context he or she encounters. Becoming aware of metacognitive factors and how they influence reading, learning specific strategies to apply to job-

related reading, and practicing new approaches to reading with materials and situations directly from the job context all may help workers become more flexible and effective readers.

Conclusion

The skills needed to adapt to all of the demands of a job, to get information quickly in order to make decisions, require the reader to be very flexible. Metacognitive awareness may allow this flexibility to develop. These subjects demonstrated metacognitive awareness, and this may influence their success with job reading. If job experience, effective use of available alternative sources of information, and awareness and control of sources of text difficulty influence reading ability and help it develop, then these subjects' metacognitive awareness may be an organizer for the reading process.

In the end, what most concerns the worker is the immediate task at hand, the job that must be finished today so that others can be tackled tomorrow. Reading is a vital, effective tool on the job that must be considered in the proper perspective. One subject summed up his view of the role of reading in his job this way:

> There's an infinite amount of technical information available, and you just cannot assimilate it all in the time available -- and still do anything else. I have to take information and make use of it. I have to turn it into a product that we can sell. The world can publish faster than I can read, no matter how fast I can read. Like all activities, you become very specialized. I have to sort out and make sure that the

specific material I'm reading is related to turning into actual dollars and cents at the end. That's why I'm here.

In the world of business and industry, where a worker's success may hinge on accurate and efficient information gathering, metacognition is an important and effective working tool.

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